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MONTHLY  
MICROCLIMATIC SUMMARY

AUGUST 1967

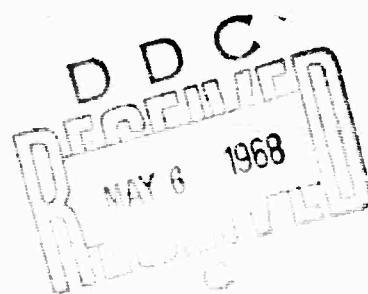
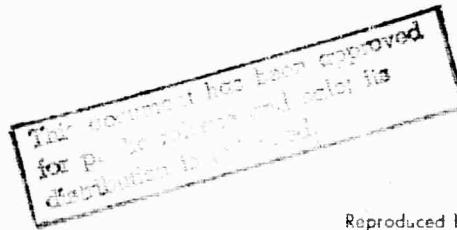
ENVIRONMENTAL DATA BASE  
FOR REGIONAL STUDIES IN THE HUMID TROPICS

USATECOM Project No. 9-4-0013-01

US ARMY  
TROPIC TEST CENTER  
Fort Clayton, Canal Zone

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MONTHLY  
MICROCLIMATIC SUMMARY

AUGUST 1967

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USATECOM Project No. 9-4-0013-01

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Conducted by

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Port Clayton, Canal Zone  
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## MONTHLY MICROCLIMATIC SUMMARY

### Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropic Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N,	79° 33'W
Chiva Chiva	09° 01'N,	79° 35'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46 meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are emplaced in the immediate vicinity on or near the ground. All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

The relative humidity data contained in this report required some adjustment due to the difficult problems in maintaining hair hygrometers in the humid tropics. The hygrometers show saturation at a time when the psychrometer shows a relative humidity well below 100%. For this reason the hourly measurements made by means of a hair hygrometer have been modified on the basis of simultaneous psychrometer readings of other levels. Details will be given in the fourth Semianual Report. It can be assumed that the means of relative humidity presented in this volume are very close to the true means.

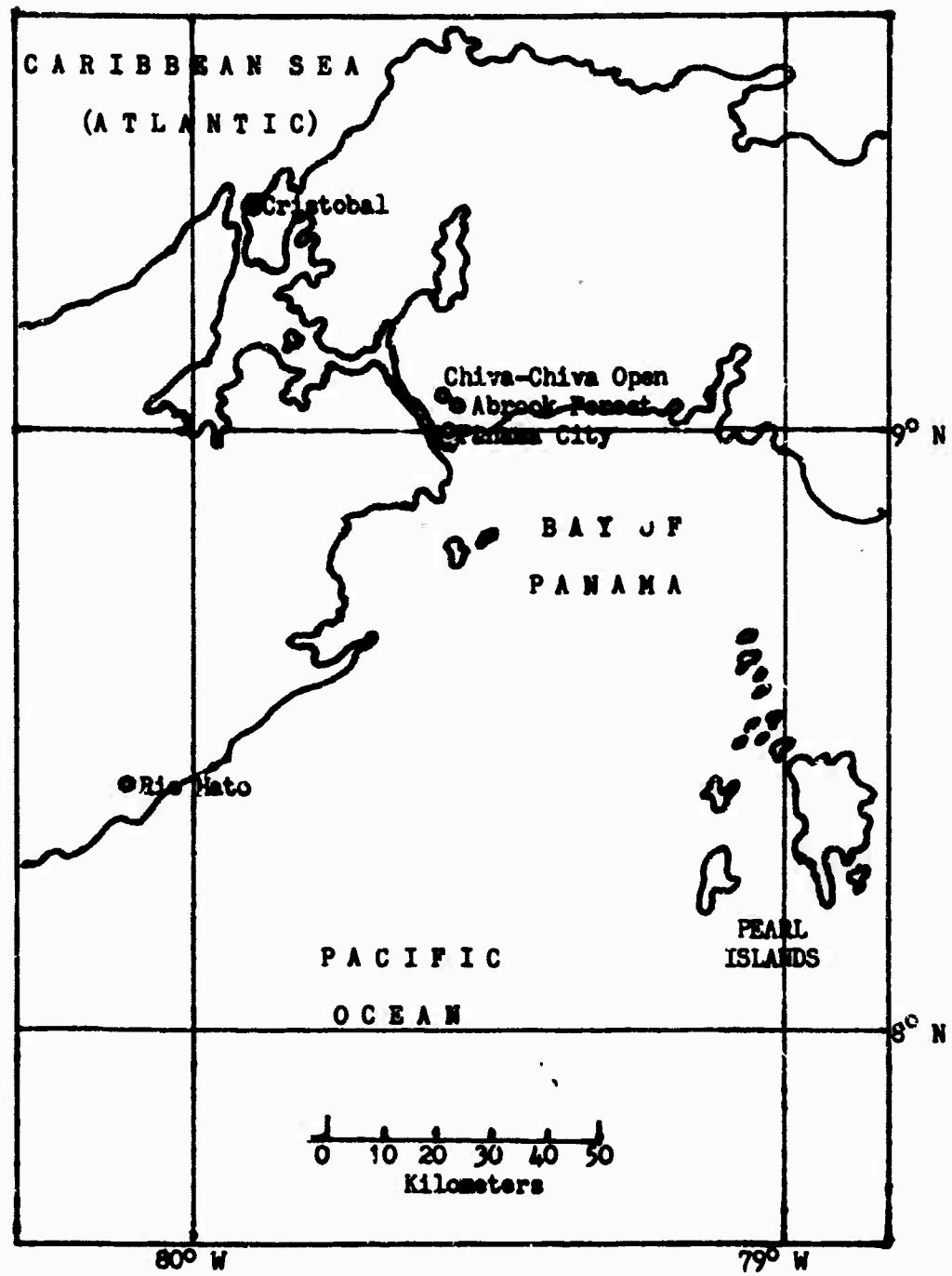


FIGURE 1.  
LOCATION MAP, Isthmus of PANAMA

**FIGURE 2. FREQUENCY OF OBSERVATIONS**

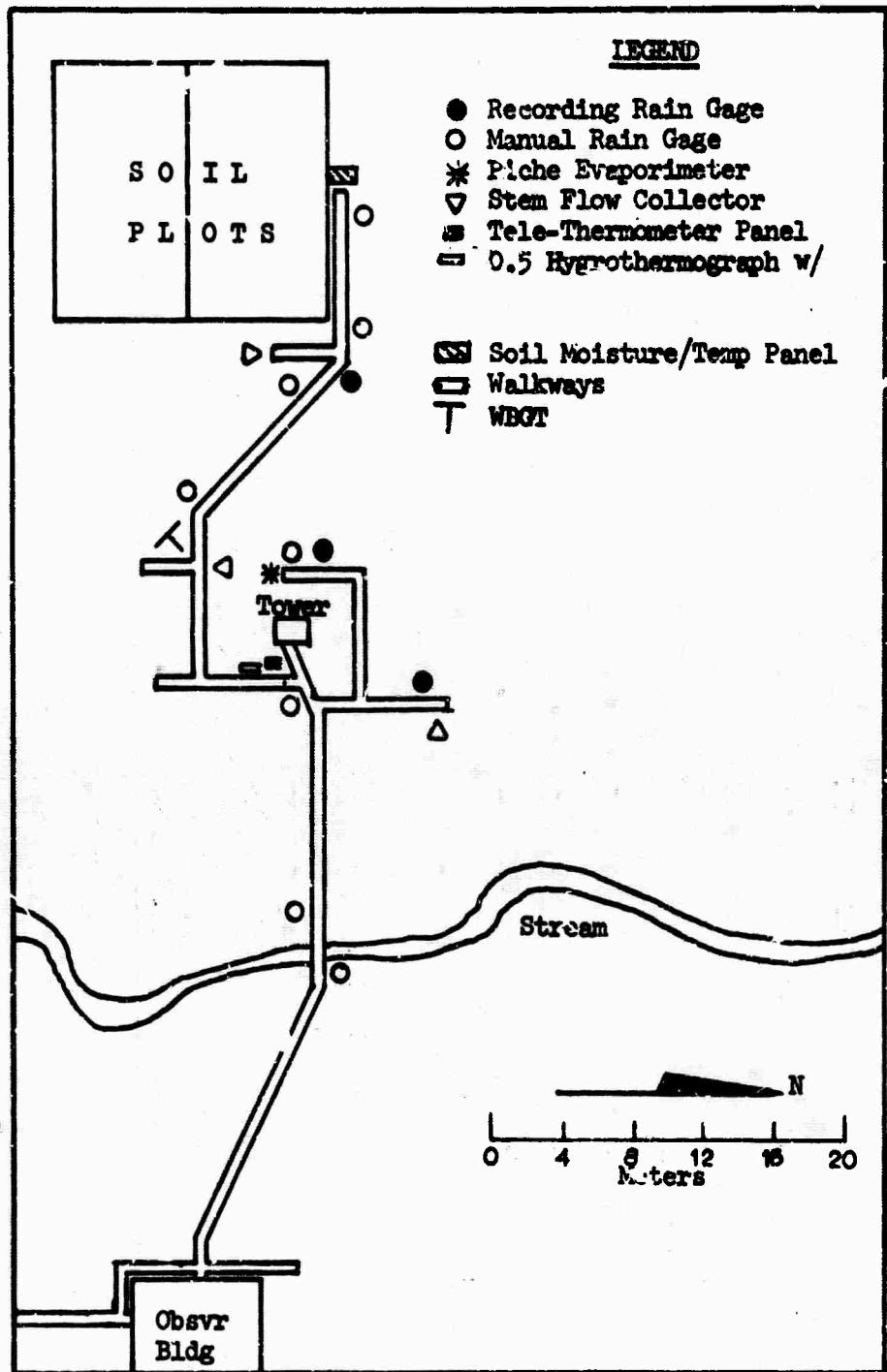
#	Element	Sfc	0.5	1.0	2.0	4.0	8.0	13.5	26.5	28.5	46.0	Frequency
<b>Temperature:</b>												
Dry Bulb	-	1	1	1	1	2	1	1	-	-	1	Hourly*/Continuously
Wet Bulb	-	1	-	1	1	-	-	-	-	-	-	Hourly*/Continuously
Grass Minima	3	-	-	-	-	-	-	-	-	-	-	Once Daily
WBGT Index	-	-	1	-	-	-	-	-	-	-	-	Hourly (0600-1900 EST)
Relative Humidity	-	1	1	1	1	-	1	1	-	1	1	Hourly*/Continuously
Barometric Pressure	-	1	-	-	-	-	-	-	-	-	-	Continuously
Evaporation	-	1	-	-	-	-	2	2	-	2	Once Daily	
<b>Precipitation:</b>												
Recording Gage	-	-	1	-	-	-	-	-	-	2	Continuously	
Manual Gage	-	-	2	-	-	-	-	-	-	-	4 Times Daily	
Stem Flow	-	-	-	2	-	-	-	-	-	-	-	4 Times Daily
<b>Wind:</b>												
Direction	-	-	-	1	-	3**	1	1**	1	-	2	Continuously
Speed	-	-	-	3**	1	-	3**	1**	1	-	2	Hourly*/Continuously

1. Albrook and Chiva Chiva
2. Albrook only
3. Chiva Chiva only

\* Observations made with sling psychrometer when recorders are inoperative.

\*\* Hourly

# Instrument descriptions are contained in the Environmental Data Base semiannual reports.



**FIGURE 3.**

**ALBROOK FOREST SITE, GENERALIZED PLOT**

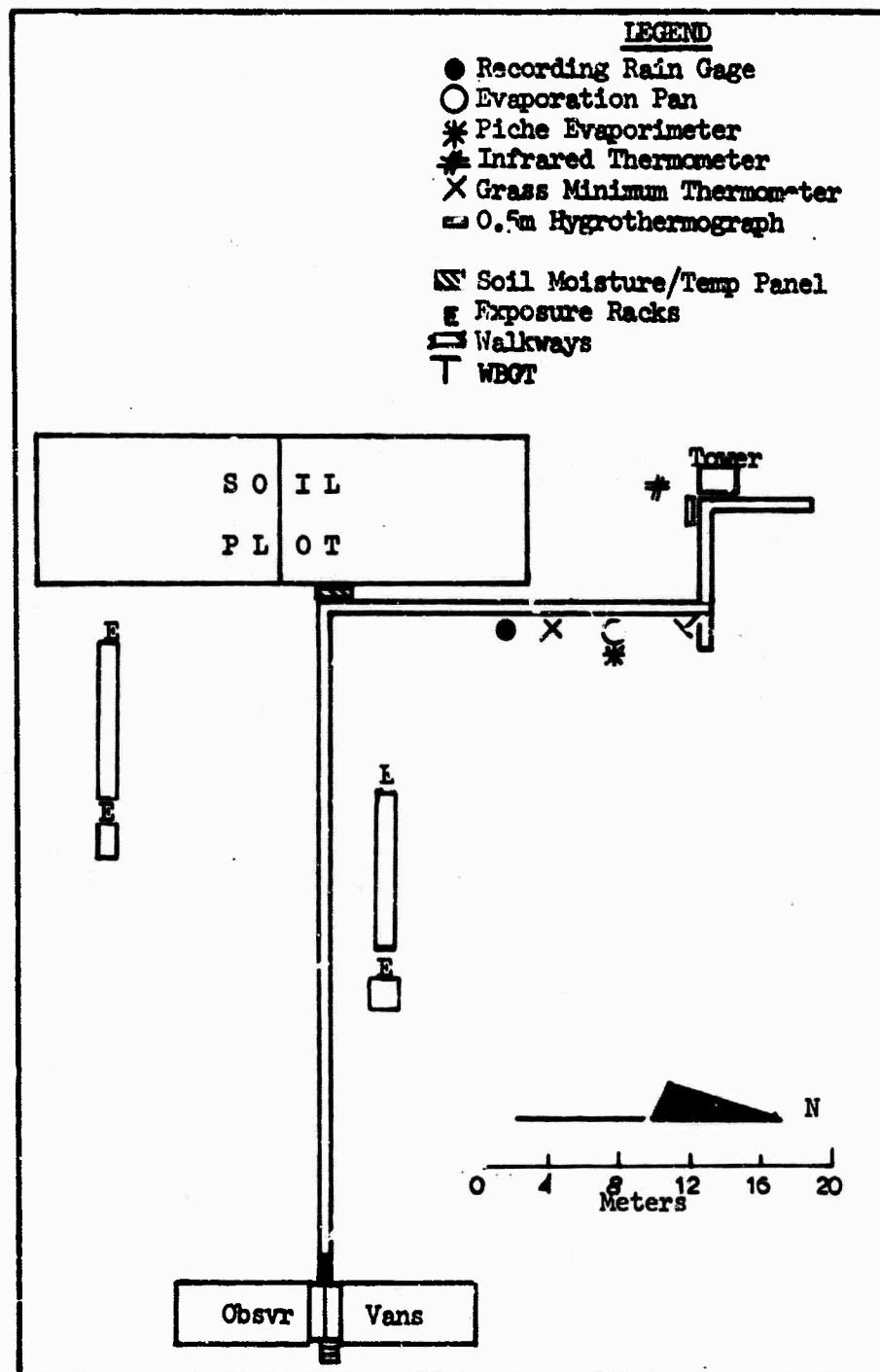


FIGURE 4.  
CHIVA CHIVA OPEN, GENERALIZED PLOT

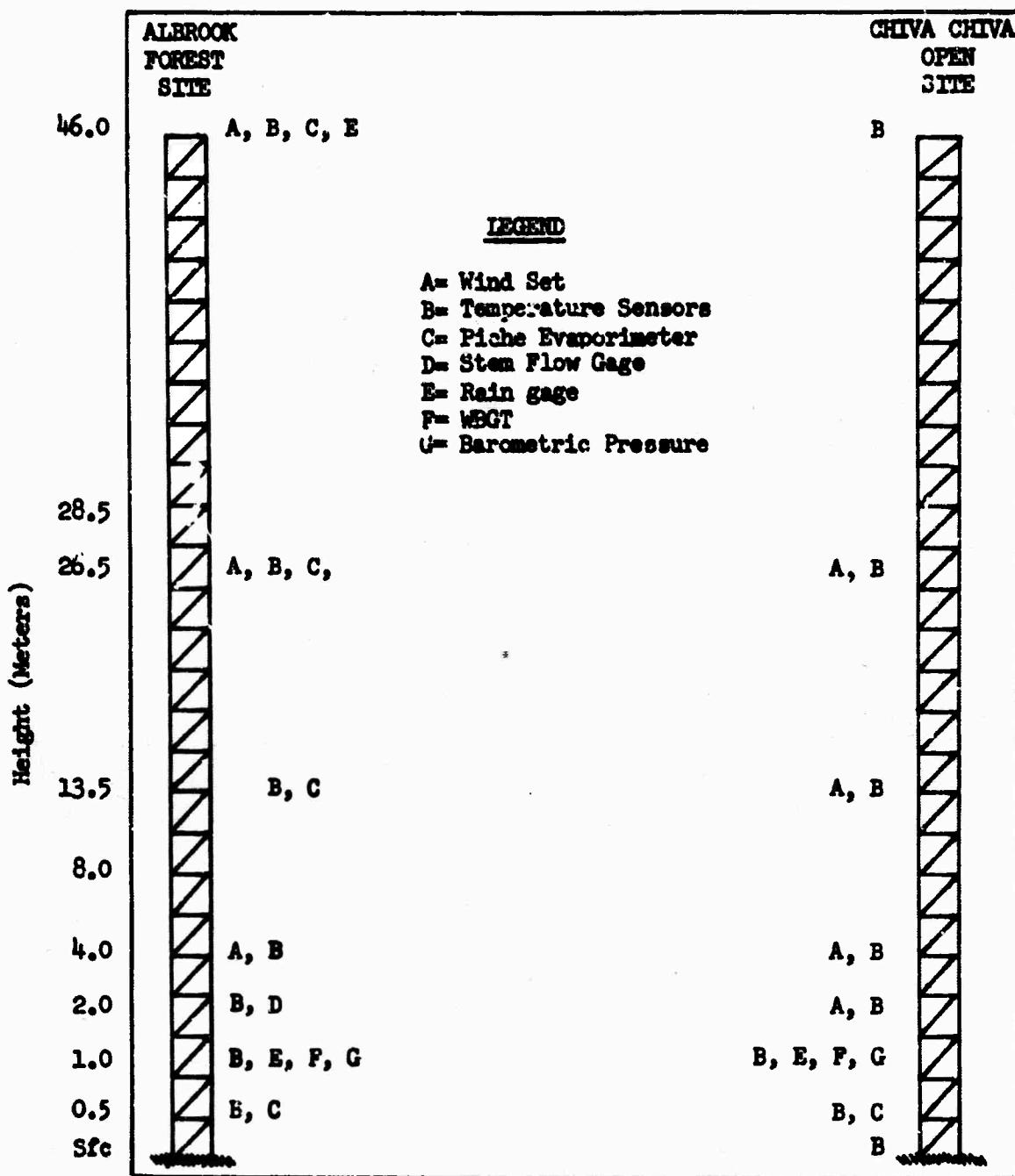


FIGURE 5. INSTRUMENT LOCATION ON TOWERS

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**

AUGUST 1967

Site	Exposure	Monthly Means of Air Temperature by Hour (°F)																								Monthly Summary			
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Min.	Mean	Max.
46.0 m	75.5	75.4	75.2	75.0	74.9	74.8	75.4	77.1	79.5	81.4	82.6	82.7	82.5	81.4	81.2	80.3	79.1	77.9	76.7	76.4	76.2	76.1	75.8	75.7	740	71.2	77.9	88.2	
28.5 m																													
26.5 m	75.4	75.2	75.1	74.9	74.8	74.7	75.3	77.2	79.7	81.7	83.4	83.4	82.5	82.0	80.8	79.8	78.5	76.8	76.3	76.0	75.9	75.7	75.5	744	71.4	78.1	89.0		
13.5 m	75.2	74.9	74.8	74.6	74.5	74.4	74.7	76.3	78.3	80.1	81.7	82.2	82.1	81.4	81.0	80.3	79.3	78.1	77.0	76.4	76.0	75.7	75.3	75.2	666	71.0	77.5	87.5	
8.0 m																													
4.0 m	74.7	74.6	74.5	74.3	74.2	74.2	75.0	76.9	78.7	80.1	81.6	81.3	80.5	79.9	79.3	78.7	77.4	77.4	76.0	76.4	76.0	75.7	75.5	74.9	735	70.0	77.1	87.2	
2.0 m	74.7	74.6	74.5	74.2	74.2	74.2	75.0	76.7	78.4	79.7	81.1	81.1	80.3	79.8	79.1	78.7	77.4	77.4	76.4	76.1	75.7	75.5	74.9	74.8	736	70.0	77.0	86.5	
1.0 m	74.8	74.7	74.5	74.3	74.2	74.2	75.0	76.6	78.3	79.6	80.9	80.8	81.1	80.3	79.6	79.0	78.7	77.5	76.6	76.2	75.8	75.6	74.9	74.9	736	70.0	77.0	86.7	
0.5 m	75.1	75.0	74.9	74.7	74.5	74.4	74.9	76.4	78.0	79.3	80.7	80.9	81.0	80.4	79.0	79.2	78.8	77.6	76.7	76.3	76.1	75.8	75.2	75.1	722	71.3	77.1	86.1	

Site	Exposure	Monthly Means of Air Temperature by Hour (°F)																								Monthly Summary			
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Min.	Mean	Max.
46.0 m	76.0	75.8	75.7	75.5	75.4	75.5	75.5	76.5	78.5	80.4	81.8	82.2	81.9	81.0	80.4	79.8	78.8	78.2	77.5	77.0	76.6	76.6	76.4	76.1	744	70.6	77.9	88.8	
28.5 m																													
26.5 m	75.6	75.3	75.2	75.1	75.1	75.3	76.7	78.7	80.4	81.9	82.4	82.2	81.1	80.6	80.6	79.9	78.9	78.2	77.3	76.8	76.5	76.3	76.2	75.7	744	70.5	77.8	87.7	
13.5 m	75.5	75.2	75.0	74.9	74.9	74.9	75.4	77.0	79.0	80.9	82.2	82.6	82.5	81.5	80.8	80.2	79.2	78.4	77.4	76.8	76.5	76.3	75.9	75.5	744	70.5	77.9	88.8	
8.0 m																													
4.0 m	74.8	74.5	74.3	74.0	74.0	74.1	75.7	78.6	80.7	82.7	84.0	84.1	84.2	82.7	81.8	80.9	79.5	78.5	77.1	76.5	76.1	75.8	75.1	74.7	743	69.5	78.1	89.7	
2.0 m	74.7	74.5	74.2	74.0	73.9	73.9	75.7	78.8	81.2	83.1	84.8	84.8	84.8	83.2	82.3	81.5	80.0	78.6	77.2	76.5	75.9	75.7	75.0	74.6	742	69.0	78.3	91.4	
1.0 m	74.5	74.3	74.0	73.7	73.7	73.7	75.8	79.0	81.6	84.1	85.3	85.3	84.8	83.3	82.2	81.2	79.6	78.1	76.7	76.0	75.4	75.2	74.8	74.5	741	68.3	78.2	93.7	
0.5 m	74.4	74.2	74.0	73.7	73.6	73.5	75.7	79.2	82.0	84.2	85.9	85.5	84.9	83.6	82.2	81.4	79.7	78.2	76.7	76.0	75.4	75.2	74.8	74.4	734	68.5	78.2	93.3	

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**  
**AUGUST 1967**

Exposure		Monthly Ranges of Air Temperature by Hour (°F)																								Monthly Summary*		
Site	Level	0:	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24			
	46.0 m	6.1	6.1	5.6	5.7	6.1	5.7	5.6	6.0	10.2	11.4	10.9	13.0	13.9	14.5	15.7	14.8	13.9	12.1	8.0	6.9	6.7	6.3	6.1	6.0			
	28.5 m																											
	26.5 m	5.1	5.0	4.8	5.0	5.6	5.9	5.5	7.5	10.4	11.9	11.5	15.0	15.2	15.5	15.7	15.1	14.9	13.6	8.9	7.1	5.8	5.5	5.3	5.2			
	13.5 m	8.0	8.3	7.2	7.2	8.0	8.0	8.1	11.1	11.0	10.8	12.1	14.0	14.3	16.0	14.2	14.0	14.0	12.9	10.0	7.1	6.7	6.3	5.8	5.3			
	8.0 m																											
	Albrook (Forest site)																											
	4.0 m	4.3	6.0	5.6	6.5	6.6	6.8	7.3	8.8	9.8	9.9	11.3	14.2	14.4	12.3	12.0	11.5	11.0	11.8	9.5	9.0	6.9	5.3	5.2	5.0			
	2.0 m	4.4	6.2	5.5	6.5	6.6	7.0	7.2	8.6	9.5	9.5	11.0	13.5	13.2	12.5	12.0	10.5	10.3	11.4	9.5	8.8	6.3	5.5	5.2	4.9			
	1.0 m	4.2	6.4	5.4	6.2	6.2	7.0	7.2	8.3	9.8	9.3	11.0	13.7	12.8	12.3	12.1	10.5	9.4	11.0	10.0	8.3	6.7	6.4	5.1	5.1			
	0.5 m	4.0	6.2	5.1	6.1	5.8	5.9	6.8	7.8	9.5	8.2	10.2	12.5	11.3	12.7	11.9	10.8	10.5	9.9	8.4	8.1	6.4	6.3	4.9	5.1			

\* No monthly summary  
was computed for  
the ranges.

46.0 m	6.3	5.5	4.3	5.1	5.0	5.5	6.0	7.6	9.6	12.7	10.1	15.9	15.0	16.6	14.8	13.7	16.9	13.0	10.5	8.9	5.5	6.0	6.3	6.7				
28.5 m																												
26.5 m	6.5	5.5	4.6	5.3	5.1	5.5	5.9	7.8	9.2	11.8	10.2	15.3	14.5	15.4	14.0	12.2	17.0	12.9	11.1	8.5	6.0	6.0	6.6	7.2				
13.5 m	6.7	5.3	4.4	5.4	5.3	5.4	5.6	8.4	9.9	12.3	10.8	17.0	14.5	16.5	14.1	13.5	17.5	13.4	10.6	9.2	7.5	5.9	6.7	7.3				
8.0 m																												
	Chirva (Open site)																											
	4.0 m	6.9	5.2	4.9	5.3	5.9	6.1	5.4	10.8	12.8	12.9	15.2	16.0	14.6	16.0	17.7	14.5	10.5	9.2	8.4	7.8	6.7	6.8					
	2.0 m	6.3	5.8	5.3	5.8	5.8	5.9	10.9	12.9	14.0	12.5	19.2	17.0	18.8	15.9	16.5	19.1	15.9	11.0	9.6	8.7	7.2	7.3	6.8				
	1.0 m	6.5	5.5	5.8	6.3	6.4	6.1	4.9	11.2	13.5	12.1	14.2	21.7	19.9	19.6	16.0	17.5	18.9	15.3	9.3	8.9	7.8	7.0	6.8	6.7			
	0.5 m	6.3	5.6	5.3	6.2	5.5	5.9	5.0	11.9	13.8	12.9	15.6	21.3	19.5	20.2	15.5	17.6	18.7	14.7	9.3	8.9	7.8	6.8	6.8				

SUMMARY OF METEOROLOGICAL OBSERVATIONS  
HOUSIBI Y DATA

AUGUST 1967

Exposure	Site	Monthly Means of Relative Humidity by Hour (%)												Monthly Summary																
		Level 01	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	N <sub>24</sub>	S <sub>24</sub>	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	94	94	94	94	94	93	90	64	77	75	75	77	79	80	82	84	87	90	91	92	92	93	94	734	63	67	97		
	28.5 m	95	95	95	95	95	95	91	85	80	76	76	78	79	80	83	85	85	93	94	94	95	95	95	738	64	89	98		
	26.5 m	95	95	95	95	95	95	95	91	85	80	76	76	78	79	80	83	85	85	93	94	94	95	95	95	665	63	91	98	
	13.5 m	96	96	96	96	96	96	95	90	86	82	80	81	83	84	87	88	90	92	93	95	95	96	96	96	665	63	91	98	
	8.0 m																													
	4.0 m	97	97	96	97	97	97	96	95	91	89	84	85	85	86	88	90	90	92	93	94	95	95	97	96	734	66	93	100	
	2.0 m	97	97	97	97	97	97	97	96	93	90	87	86	86	86	88	89	92	91	93	94	94	95	96	97	97	97	93	100	
	1.0 m	97	97	97	97	97	97	97	96	94	92	88	89	87	89	92	93	92	93	94	94	95	95	97	97	735	69	93	100	
	0.5 m	97	96	97	96	97	96	97	97	96	94	93	90	90	90	90	92	93	93	94	95	95	95	95	95	97	97	97	94	100

CH3VVA CH3VVA (Open slate)									
This level was not instrumented for relative humidity at this time									
46.0 m	93	94	94	94	94	94	94	94	94
28.5 m	94	94	95	95	95	95	94	92	90
26.5 m	94	94	95	95	95	95	94	92	91
13.5 m	94	94	95	95	95	95	91	86	83
8.0 m	94	94	95	95	95	95	82	78	76
4.0 m	96	96	97	97	96	94	88	84	79
2.0 m	96	96	96	96	96	96	94	88	83
1.0 m	96	96	97	97	97	97	95	88	82
0.5 m	97	97	97	97	97	98	95	89	84

SUMMARY OF METEOROLOGICAL OBSERVATIONS  
HOURLY DATA

ב' יט' היליגן

Exposure	Site	Level	Monthly Ranges of Relative Humidity by Hour (%)																								Monthly Summary*
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Albrook (Forest site)	46.0 m	9	9	7	7	7	9	14	26	31	30	32	33	31	30	28	29	23	18	15	13	12	8	9			
	28.5 m	5	6	5	7	6	6	15	25	30	29	31	26	29	31	28	29	26	16	13	9	6	6	6	6		
	26.5 m	5	5	5	4	4	4	5	19	23	30	33	32	31	28	26	25	18	15	10	9	8	7				
	13.5 m	5	6	5	4	4	4	5	19	23	30	33	32	31	28	26	25	18	15	10	9	8	7				
	8.0 m																										
	4.0 m	7	14	14	13	14	10	15	15	19	22	29	30	30	32	33	21	19	20	18	17	17	16	10	9		
	2.0 m	8	14	14	13	14	11	15	15	17	20	28	29	25	26	26	18	18	18	16	16	16	16	10	8		
	1.0 m	8	14	14	13	13	10	15	14	16	18	30	24	25	32	20	15	17	17	15	16	15	17	8	8		
	0.5 m	6	15	14	13	13	10	12	14	15	15	23	22	18	19	21	16	18	18	15	16	16	14	6	8		

- \* No monthly summary was computed for the ranges.

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**  
AUGUST 1967

Exposure	Code <sup>1</sup>	Monthly Means <sup>2</sup> of other Elements by Hour																								Monthly Summary					
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	N <sub>cbs.</sub>	Mean	Mx.			
WB (4.0 m)	74.0	73.9	73.8	73.6	73.5	73.6	74.3	75.7	76.6	77.3	77.7	77.5	77.6	77.2	77.1	76.8	76.5	75.5	75.0	74.7	74.6	74.5	74.2	74.1	734	69.9	75.4	81.0			
WB (2.0 m)	74.0	73.9	73.8	73.6	73.6	73.6	74.3	75.7	76.8	77.5	77.9	77.7	77.8	77.5	77.3	77.1	76.7	75.6	75.1	74.8	74.6	74.3	74.1	735	69.8	75.5	81.0				
WB (0.5 m)	74.4	74.2	74.2	74.0	73.9	73.8	74.2	75.6	76.8	77.7	78.4	78.5	78.5	78.0	72.0	77.5	77.2	76.1	75.6	75.2	75.0	74.9	74.5	74.4	721	70.4	75.8	81.5			
BP	.757	.741	.727	.720	.721	.729	.746	.744	.779	.782	.776	.760	.739	.719	.703	.689	.690	.703	.718	.735	.751	.767	.775	.765	.744	.595	.740	.845			
Albrook (Forest Site)	P1	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.05	0.10	0.04	0.00	0.03	0.12	0.02	0.30	0.20	0.35	0.11	0.07	0.04	0.02	0.03	0.00	0.00	0.00	0.00	50	0.01	6.16	1.24
	P2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.03	0.05	0.01	0.01	0.01	0.11	0.01	0.33	0.13	0.37	0.12	0.06	0.09	0.05	0.00	0.00	0.00	0.00	36	0.01	4.87	1.25
	P3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.06	0.02	0.00	0.02	0.14	0.02	0.29	0.25	0.29	0.04	0.02	0.01	0.00	0.00	0.00	0.00	35	0.01	4.60	1.05	
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.19	0.01	0.06	0.02	0.05	0.10	0.01	0.40	0.29	0.25	0.06	0.06	0.01	0.00	0.00	0.00	0.00	36	0.01	4.77	1.10	
Chiva Chiva (Open Site)	PS	73.9	73.8	73.5	73.5	73.4	73.3	74.4	75.8	76.8	77.3	77.6	77.5	77.1	76.9	76.6	76.0	75.7	75.3	74.9	74.7	74.6	74.1	73.8	743	68.6	75.3	80.8			
	WB (2.0 m)	73.8	73.6	73.4	73.2	73.1	73.0	74.5	76.1	77.1	77.7	78.2	78.1	78.0	77.5	77.2	76.9	76.2	75.8	75.2	74.9	74.6	74.5	73.9	73.7	743	68.2	75.4	81.7		
	WB (0.5 m)	73.7	73.6	73.4	73.1	73.1	73.0	74.7	76.7	78.0	78.9	79.5	79.1	78.9	78.6	77.5	76.9	76.2	75.6	75.0	74.7	74.3	74.1	73.9	73.7	737	68.2	75.7	82.8		
	BP	.853	.836	.822	.816	.819	.825	.839	.857	.874	.877	.875	.864	.838	.821	.801	.787	.787	.813	.830	.847	.862	.871	.865	.743	.690	.861	.945			
	PS	0.00	0.00	0.01	0.02	0.00	0.01	0.05	0.11	0.46	0.11	0.05	0.00	0.16	0.10	0.34	0.26	0.13	0.21	0.09	0.06	0.02	0.00	0.01	0.00	0.00	54	0.01	8.61	1.60	

W8 - Wet bulb temperature (°F)  
BP - Barometric pressure (in. of Hg minus 29.0)

PS - Precipitation at 1.0 m. in open area (in.)  
P1 - Precipitation at 46.0 m. above canopy (in.)  
P2 - Precipitation under full canopy (in.)

<sup>2</sup> Monthly means of precipitation are computed for precipitation days.

Precipitation totals are substituted for the mean in the monthly summary.

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**

**HOURLY DATA**  
**AUGUST 1967**

Exposure	Site Code <sup>1</sup>	Monthly Ranges <sup>2</sup> of other Elements by Hour																								Monthly Summary*	
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
WB (4.0 m)	WB	3.4	3.5	3.2	3.5	3.8	5.0	4.0	5.2	6.0	5.5	5.2	7.7	8.4	8.5	7.9	6.2	9.3	9.0	7.6	6.9	4.8	3.5	4.0	4.3		
WB (2.0 m)	WB	3.5	3.5	3.2	3.5	3.8	4.9	4.1	5.2	6.0	5.7	5.6	8.3	9.0	8.8	8.2	8.1	9.2	9.0	7.9	7.0	4.8	3.5	4.1	4.0		
WB (0.5 m)	WB	3.4	3.8	3.4	3.5	3.7	4.5	4.6	4.7	6.2	5.6	6.6	8.5	8.6	9.2	9.2	8.5	8.9	9.3	8.0	7.5	6.1	4.7	4.5	4.1		
BP	BP	.165	.175	.175	.175	.195	.195	.195	.175	.195	.160	.165	.170	.160	.160	.155	.150	.145	.135	.130	.135	.135	.135	.145	.145		
Albrock (Forest site)	P1	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.23	0.06	0.00	0.03	0.37	0.02	1.23	0.42	0.86	0.25	0.15	0.08	0.04	0.03	0.00	0.00	0.00		
	P2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.21	0.00	1.24	0.24	0.94	0.18	0.17	0.15	0.00	0.00	0.00	0.00		
	P3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.29	0.01	1.04	0.38	1.01	0.04	0.02	0.00	0.00	0.00		
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.01	1.05	0.56	0.60	0.13	0.12	0.07	0.00	0.00	0.00	

\* No monthly summary was computed for the ranges.

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Exposure	Site Code <sup>1</sup>	Monthly Ranges <sup>2</sup> of other Elements by Hour																								Monthly Summary*
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
WB (4.0 m)	WB	4.0	4.2	4.2	4.7	4.2	4.5	4.2	6.2	6.5	5.9	5.8	9.1	8.4	8.8	7.4	7.8	11.3	10.8	8.8	6.7	5.8	4.7	5.1	5.3	
WB (2.0 m)	WB	4.5	5.5	4.0	5.0	4.8	5.1	4.1	6.5	7.1	7.0	6.2	9.7	9.0	9.6	7.5	8.5	12.0	11.3	9.5	7.5	6.5	5.0	5.5	5.8	
WB (0.5 m)	WB	4.7	5.0	4.5	5.0	4.8	4.8	3.9	7.5	8.1	6.4	7.5	11.0	10.4	10.7	8.2	9.0	12.8	10.7	8.2	7.3	5.5	4.7	5.0	5.6	
BP	BP	.155	.175	.180	.175	.190	.190	.180	.175	.170	.165	.160	.160	.175	.145	.160	.160	.160	.135	.150	.125	.135	.135	.135	.140	
PS	PS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.24	0.00	0.00	0.44	0.27	0.53	1.59	0.51	0.71	0.24	0.08	0.02	0.00	0.00	0.00	0.00	

WB = Wet bulb temperature (°F)

BP = Barometric pressure (in. of Hg minus 29.0)

PS = Precipitation at 4.0 m. in open area (in.)

P1 = Precipitation at 46.0 m. above canopy (in.)

P2 = Precipitation under open canopy (in.)

2 Monthly ranges of precipitation are computed for precipitation days.

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**  
**AUGUST 1967**

Site	Level	Monthly Means of Wind Speed by Hour (miles/hr.)																								Monthly Summary				
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	N <sub>o</sub> of Obs.	Min.	Mean	Max.	
	46.0 m	5	6	5	5	6	5	6	5	5	5	5	7	8	8	8	8	8	7	7	6	6	6	5	6	672	0	6	21	
	28.5 m	2	2	2	2	2	2	2	2	2	2	2	3	4	4	4	4	4	3	3	2	3	2	2	2	464	0	3	14	
	13.5 m																													
	8.0 m																													
	4.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	699	0	0	4	
	2.0 m																													
	1.0 m																													
	0.5 m																													
	Albrook (Forest Site)																													

Site	Level	Monthly Means of Wind Speed by Hour (miles/hr.)																								Monthly Summary				
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	N <sub>o</sub> of Obs.	Min.	Mean	Max.	
	46.0 m																													
	28.5 m																													
	13.5 m	4	3	4	3	3	3	3	4	5	5	5	6	7	7	7	6	7	5	5	4	4	4	4	3	3	743	0	5	27
	8.0 m	2	1	1	1	1	1	2	2	3	3	3	4	4	4	5	6	5	4	3	3	2	2	1	1	744	0	3	25	
	4.0 m	2	2	1	2	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	744	0	1	19	
	2.0 m	1	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	2	1	1	1	1	1	0	0	744	0	1	19	
	1.0 m																													
	0.5 m																													
	Chives Curve (Open Site)																													

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**  
**AUGUST 1967**

Site	Exposure	Monthly Ranges of Wind Speed by Hour (miles/hr.)																								Monthly Summary*
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
46.0 m	9	10	12	8	15	10	10	11	11	8	12	15	15	17	21	11	15	13	16	14	9	13				
28.5 m	5	4	4	4	5	5	5	7	7	4	14	8	10	8	10	11	10	7	8	8	14	8	5	5		
26.5 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
13.5 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
4.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
2.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
0.5 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

\* No monthly summary  
was computed for  
the ranges.

Site	Exposure	Monthly Ranges of Wind Speed by Hour (miles/hr.)																								Monthly Summary*	
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
46.0 m	Chiva Chiva (Open site)	9	10	12	13	13	7	9	9	10	9	13	13	16	13	13	9	12	26	12	11	12	8	6	10	11	
28.5 m	Chiva Chiva (Open site)	10	12	13	13	13	7	7	7	7	12	10	12	12	14	8	12	24	12	9	10	6	5	4	6		
26.5 m	Chiva Chiva (Open site)	9	6	7	8	5	4	7	7	7	12	10	12	12	14	8	12	24	12	9	10	6	5	3	3		
13.5 m	Chiva Chiva (Open site)	7	12	12	9	4	6	5	9	9	12	12	13	14	12	7	11	24	10	7	8	6	5	6	8		
8.0 m	Chiva Chiva (Open site)	3	2	2	1	2	2	3	4	3	7	8	7	7	9	6	8	19	7	5	5	3	3	2	3		
4.0 m	Chiva Chiva (Open site)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
2.0 m	Chiva Chiva (Open site)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1.0 m	Chiva Chiva (Open site)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
0.5 m	Chiva Chiva (Open site)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

## ALBROOK (Forest site) AUGUST 1967

Dir.	Relative Frequencies* of Wind Directions by Hour at 46.0 m. ( % )																								
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
N	3.2	6.4	3.2	3.2	9.7	6.4	6.4	3.2	12.9	6.6	9.7	9.7	3.2							3.2	9.7	6.4		3.2	
NNNE			6.4	3.2	6.4	3.2	6.4	3.2		3.2	3.3									6.4		3.2			
NE	3.2	3.2	3.2	3.2	6.4	3.2	3.2	6.4					3.2							3.2	9.7	3.2			
ENE		3.2					3.2		3.2			3.3							3.2	3.2			3.2		
E						3.2		3.2	3.2	3.2	6.6								3.2	3.2					
ESE						3.2		3.2		3.2									3.2	3.2					
SE	3.2					3.2	3.2	3.2											3.2	3.2					
SSE						3.2	3.2	6.4	9.7	3.3	3.2	6.4													
S							6.4	9.7	16.1	13.3	12.9	9.7	3.2								3.2				
SSW		3.2						3.2	9.7	3.2	6.6	3.2	6.4								3.2		3.2		
SW	3.2	9.7				3.2	9.7	3.2	16.1	9.7	12.9	13.3	12.9	6.4	19.4	3.2	9.7	6.4	9.7	3.2	3.2	3.2	3.2		
WSW	9.7	3.2	3.2	9.7	3.2	3.2	12.9	12.9	16.1	9.7	10.0	16.1	9.7	9.7	6.4	19.4	9.7	3.2	3.2	9.7	9.7	9.7	22.6		
W	22.6	25.8	22.6	38.7	22.6	29.0	9.7	22.6	22.6	19.4	6.4	10.0	12.9	25.8	29.0	22.6	29.0	25.8	25.8	22.6	22.6	22.6	25.8		
WNW	32.2	41.9	32.2	19.4	22.6	16.1	25.8	9.7	6.4	3.2	6.4	16.6	6.4	9.7	12.9	16.1	6.4	25.8	22.6	25.8	12.9	29.0	12.9		
NW	19.4	22.6	16.1	19.4	19.4	19.4	22.6	22.6	16.1	12.9	6.4	9.7	3.2	12.9	6.4	16.1	16.1	16.1	19.4	9.7	16.1				
NNW	3.2	3.2	3.2	6.4	9.7	9.7	6.4	3.2	6.4			9.7		6.4	12.9	6.4	3.2			9.7	16.1	3.2			
CALM	6.4	3.2		6.4	6.4				3.2	3.3	6.4	3.2	3.2	6.4	3.2	6.4	3.2	6.4	9.7	9.7	12.9	9.7	9.7		

• Note: Due to rounding, percentage totals do not equal 100%.

## ALBROOK (Forest site) AUGUST 1967

Relative Frequencies\* of Wind Directions by Hour at 26.5 m.  
(%)

Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	6.4	3.2	9.7	9.7	3.2	9.7	6.4	12.9	3.2	9.7	9.7		6.4	6.4	9.7	12.9	9.7	19.4	3.2	6.4	6.4	9.7	3.2	
NNE	3.2	3.2				3.2			3.2		3.3	12.9	3.2					3.2	3.2	6.4	3.2	9.7	3.2	
NE	3.2	6.4		6.4	3.2		6.4										3.2	3.2	3.2	6.4	3.2	3.2	3.2	
ENE		3.2		3.2				3.2															3.2	
E						3.2	6.4	9.7	3.2	3.2	3.3	3.2							3.2				3.2	
ESE		3.2				3.2																		
SE	6.4	3.2					6.4	3.2	3.2	6.6	6.6				3.2	3.2								
SSE									3.2	3.2	3.3	6.4	9.7											
S						3.2	3.2	6.4	16.1	25.8	23.3	9.7	3.2											
SSW		3.2	3.2					6.4				3.3	6.4											
SW		3.2	3.2	6.4	6.4		6.4	6.4	6.6	6.6	3.2	3.2												
WSW			3.2				6.4			6.4														
W	12.9	6.4	6.4	9.7	3.2	6.4	9.7	3.2	6.4	3.2	3.3	9.7	22.6	12.9	12.9	12.9	12.9	12.9	3.2	6.4	6.4	9.7	6.4	
WNW	3.2	19.4	6.4	16.1	9.7	6.4	9.7	3.2	6.4	6.4	9.7	9.7		3.2	9.7	19.4	6.4	16.1	9.7	12.9	6.4	3.2	19.4	
NW	25.8	32.2	29.0	25.8	12.9	19.4	19.4	25.8	25.8	19.4	22.6	16.1	23.3	12.9	19.4	25.8	19.4	12.9	35.5	25.8	35.5	16.1	29.0	22.6
NNW	25.8	12.9	19.4	19.4	32.2	19.4	25.8	9.7	9.7	12.9	6.4	6.4	10.0	16.1	16.1	12.9	19.4	16.1	22.6	25.8	32.2	35.5	22.6	
CALM	19.4	16.1	22.6	19.4	16.1	22.6	16.1	16.1	19.4	9.7	6.4	6.4	10.0	6.4	3.2	6.4	9.7	12.9	9.7	12.9	16.1	12.9	19.4	

\* Note: Due to rounding, percentage totals do not equal 100%.

## ALBROOK (Forest site) AUGUST 1967

Dir.	Relative Frequencies* of Wind Directions by Hour at 4.0 m. ( % )																							
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N											3.7	6.6	3.3		3.3	3.3								
NNE																								
NE																	3.3	6.6						
ENE																	3.3							
E																	3.3							
ESE																	3.3							
SE																	3.3							
SSE																	3.3							
S																	3.3							
SSW																	3.3							
SW																	3.3							
WSW																	3.3							
W																	7.3	3.3	3.3					
WNW																	3.3							
NW																	6.6	3.3	3.3					
NNW																	6.6		3.3					
CALM	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	92.3	88.9	93.0	79.7	83.0	83.0	56.4	96.3	89.7	93.0	96.3	96.3	96.3	

\* Note: Due to rounding, percentage totals do not equal 100%.

CHIVA C CHIVA (Open site) AUGUST 1967

Relative Frequencies\* of Wind Directions by Hour at 26.5 m.  
( % )

D:	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
N	16.1	9.7	6.4	25.8	12.9	16.1	12.9	9.7	25.8	6.4	6.4	12.9	12.9	6.4	12.9	16.1	19.4	25.8	16.1	6.4	29.0	22.6	19.4	22.6	
NNE	9.7	9.7	12.9	16.1	6.4	12.9	12.9	3.2	9.7	9.7	3.2	3.2	9.7	6.4	6.4	3.2	3.2	12.9	12.9	3.2	3.2	6.4	6.4		
NE	3.2	6.4	3.2	3.2	3.2	6.4	6.4	3.2	3.2	3.2	6.4	3.2	6.4	6.4	3.2	6.4	3.2	6.4	3.2	12.9	9.7	9.7	3.2	3.2	
ENE	3.2	3.2	3.2	3.2	3.2	3.2	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	3.2	3.2	
E	3.2	3.2																						3.2	
ESE																									
SE																									
SSE																									
S																									
SSW																									
SW	3.2	6.4																							
WSW	3.2	6.4																							
W	9.7	3.2	6.4	9.7	6.4	6.4	3.2	9.7	9.7	6.4	6.4	9.7	12.9	6.4	9.7	9.7	9.7	9.7	9.7	9.7	3.2	3.2	3.2		
WNW	6.4	22.6	12.9	6.4	3.2	6.4	9.7	3.2	9.7	3.2	6.4	6.4	6.4	16.1	3.2	6.4	9.7	3.2	6.4	6.4	6.4	6.4	6.4		
NW	16.1	9.7	12.9	19.4	22.6	25.8	22.6	38.7	12.9	12.0	22.6	19.4	16.1	19.4	17.9	25.8	12.9	19.4	25.8	19.4	6.4	22.6	9.7	35.5	
NNW	25.8	19.4	29.0	6.4	19.4	9.7	22.6	16.1	12.9	25.8	19.4	12.9	16.1	19.4	12.9	25.8	9.7	29.0	25.8	9.7	22.6	22.6	32.2	9.7	
CALM	3.2	12.9	3.2	3.2	12.9	6.4	9.7	3.2																9.7	9.7

\* Note: Due to rounding, percentage totals do not equal 100%.

CHIVA CHIVA (Open site) AUGUST 1967

Wind Direction	Relative Frequency (%)
N	10
NE	10
E	10
SE	10
S	10
SW	10
W	10
NW	10

\* Note: Due to rounding, percentage totals do not equal 100%.

# SUMMARY OF NON HOURLY DATA

AUGUST 1967

Summary of Elements with Non-hourly Frequencies of Observation						
Site	Element, Units and Exposure	Description	Number of Obs.	Minimum Value	Mean or Total Value	Maximum Value
Albrook (Forest site)	WBGT Index <sup>1</sup> (at 1.0 meters)	Index value	434	70.2	77.4	82.6
		Dry bulb temp.	434	69.5	78.3	87.1
		Wet bulb temp.	434	69.5	76.8	82.0
		Black bulb temp.	434	72.0	78.8	87.5
	Evaporation <sup>3</sup> (in. at 4 levels)	Piche (46.0 m)	31	0.079	7.353*	0.451
		Piche (26.5 m)	31	0.055	5.201*	0.317
		Piche (13.5 m)	29	0.012	2.156*	0.179
		Piche (0.5 m)	25	0.006	0.889*	0.073
	Precipitation from Raingauge Network <sup>2</sup> (in. at 1.0 meters)	Gauge # 1	20	0.01	6.31*	2.30
		Gauge # 2	20	0.02	6.58*	2.75
		Gauge # 3	20	0.02	7.13*	2.36
		Gauge # 4	20	0.01	6.88*	2.33
	Stem Flow <sup>2</sup> (in. at 2.0 meters)	Gauge # 5	20	0.01	5.02*	1.61
		Gauge # 6	20	0.02	5.64*	1.45
		Gauge # 7	21	0.02	5.43*	1.93
		Gauge # 8	20	0.01	5.48*	1.81
Chiva Chiva (Open site)	WBGT Index <sup>1</sup> (at 1.0 meters)	Small tree	20	0.01	5.61*	1.13
		Medium tree	18	0.01	6.24*	3.04
		Large tree	9	0.01	40.57*	34.84
	Evaporation <sup>3</sup> (in. at 0.5 meters)					
		Piche	31	0.012	4.372*	0.305
		Pan	28	0.003	4.73*	0.939
	Minimum Grass temp. <sup>3</sup> (°F at grass tips)					
		None	28	68.2	70.9	74.0

1 - Hourly observations between 0600 and 1900 hours inclusive

\* Total Values

2 - Six hourly observations

3 - Daily observations

**UNCLASSIFIED**

Security Classification

**DOCUMENT CONTROL DATA - R & D**

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13. ABSTRACT  This report contains detailed microclimatic data for August 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and/or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.		

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Security Classification

KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Climate						
Microclimatology						
Tropic Environment						
Humid Tropics						
Panama Canal Zone Microclimatology						
Data Base						